M.O. 294.

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## Abnormal Rainfalls

In continuation of the articles on "Extremes of Temperature" and "Abnormal Wind Velocities," published in the numbers of the *Meteorological Magazine* for August and October, some notes on abnormally heavy falls of rain in different periods may be of interest. As in the previous articles, the information does not pretend to be exhaustive, and no doubt many readers will be able to supply additional records of interest. The British Isles have already been adequately dealt with from time to time, and especially in Dr. Glasspoole's note on p. 18, so that we may confine our attention to extra-British regions.

Dealing first with annual totals, the name of Cherrapunji, in the Khasi Hills of Assam, springs at once to the mind. The official annual average here is 424·0 inches, but the official gauge is not in the wettest part of the area; 18 years observations at the Welsh Mission House gave an average fall of 441·7 inches, and 12 years at Shadwells House an average of 449·6 inches. "Cherra Poonjee is on the crest of the southern scarp, at an elevation of 4,000 feet, overlooking the plains of Sylhet. It stands on a little plateau of thick-bedded sandstones, bounded on two sides by precipices of 2,000 feet sheer descent, which close in gorges, debouching southwards on the plains. The south-west wind, after sweeping over the inundated alluvial tract, blows up these as well as on the southern face of the general scarp, and, having reached the heads of the gorges, ascends vertically. Thus, Cherra Poonjee in the summer monsoon season is sur-

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rounded, or nearly so, by vertically ascending currents of saturated air, the dynamic cooling of which is the cause of the enormous precipitation which has made this place famous. Moreover, it is at the elevation of 4,000 feet, which Mr. Hill finds, in the Himalaya, to be that of maximum precipitation. It is almost certain that the annual average varies greatly in different parts of the station, although the whole extent of the plateau is not much more than a couple of square miles. Some of the earlier registers, which were those of rain-gauges near the centre of the plateau, show a higher rainfall than those kept in recent years further north, and under the lee of a ridge that crowns its western margin."*

The station of Manoyuram, at an elevation of about 3,500 feet and a short distance south of Cherrapunji, may be even wetter, a five year period giving an average of 498·65 inches, the months of June to August averaging over 100 inches each.

It is this extremely local nature of the fall which makes the true average rainfall of the Cherrapunji district so problematical. The earlier registers were kept at the old and now abandoned station, which was unquestionably wetter than the present station, but in addition the records themselves are open to doubt. A register for 1861, from which March is missing, gave the enormous total of 905·12 inches in the remaining eleven months, of which 336·14 inches are returned for July alone. "Of the circumstances under which these were kept nothing is known,"† but they are not confirmed by comparison with the rainfall at Sylhet, 20 miles away, for the same years. Better authenticated is the fall of 264 inches in August, 1841, when 30 inches or more fell on each of five successive days. The rainfall of Cherrapunji is the more remarkable when it is considered that very nearly the whole of it falls within the space of a few months. The average monthly falls are as follows :—

| Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0·5 | 3·1 | 9·1 | 31·7 | 43·5 | 94·2 | 101·8 | 82·9 | 34·9 | 19·5 | 2·4 | 0·4 |

For many years Cherrapunji held its place as the wettest known spot on earth, but recent measurements in the Hawaiian Islands suggest a still higher annual total. On the windward slopes of Mount Waialeale, "during the periods August 2, 1911, to March 26, 1914, and May 31, 1915, to August 13, 1917, a total of 1,782 days, there was recorded...a total precipitation of 2,325 inches... In a 365-day year this would amount to 476 inches. The years 1918 and 1914, for which, unfortunately, no records were obtained, were the wettest since the local Weather Bureau office was established in the Hawaiian Islands. Though comparative estimates are always unsatisfactory,

* *Indian Meteor. Memoirs III.* (1886), p. 44.

† *London, Q. J. R. Meteor. Soc.*, 17 (1891), p. 149.

reliable records obtained at near-by stations indicate that both in 1914 and 1918 the rainfall at this station exceeded 600 inches,"* and the true annual average may well be above 500 inches. There are several other rainy spots in the islands (*e.g.* Honomu, 379 inches), which seem to justify Mr. Larrison's nickname of "Uncle Sam's Dampest Corner." The gauge on Mount Waialeale was very difficult of access, and was not visited regularly, so that monthly and daily totals are not available ; at the regular stations the largest total in 24 hours was 31·95 inches at Honomu on February 20th, 1918.

The following note has been extracted from a paper *Flood Absorption in Tanks*, by S. K. Gurtu, Gwalior, 1916: "Mr. R. B. Joyner, C.I.E., M.I.C.E., Hydraulic Consulting Engineer, says, in a sketch of the Hydro-electric scheme of Bombay: 'It has hitherto always been thought that Cheraponji, in the Khasia Hills, had the greatest rainfall in the world, but in the catchment area of the Lakes for this scheme over 546 inches have been measured in one monsoon of which 440 inches (nearly 37 feet depth) fell in 31 consecutive days.' The conditions of Ghat catchment areas do not apply to the interior." The wettest place in Africa so far as is known is Debundscha Plantation, at the foot of the Cameroon Peak, totals for which are given on p. 16. With an annual average of 369·2 inches this station comes third on our list. For an eleven year period here, Hann gives an average of 412·2 inches, and at the neighbouring station of Bibundi, for an 8½ year period, 403·2 inches, but these would seem to refer to a series of abnormally rainy years. As these stations are very near sea level and the rainfall presumably increases upwards, much higher totals may occur on the slopes of the mountain. Some heavy rainfall totals are found in Formosa, where Kashōryo has an average of 282·5 inches, while at Funkiko as much as 82 inches fell in three days, causing heavy floods. Other rainy places are Tami Island, off Papua (254·7 inches) ; Greytown, Honduras (251 inches) ; Launglon, Burma (226·2 inches) ; Thandaung, Burma (226·1 inches) ; and Padupola, Ceylon (219·1 inches). At all these places the cause of the heavy rain is roughly the same as at Cherrapunji ; moist warm air straight from its passage across the ocean striking a ridge of high ground at right angles to its course and being forced to ascend almost vertically.

The heaviest rainfall in Europe appears to occur at Crkvice, on the Gulf of Cattaro—again a hollow, ringed by mountains on three sides, on the fourth open to the sea and the prevailing southerly winds—where the annual average is 182·8 inches,

* Larrison, G. K. "Uncle Sam's Dampest Corner." *M. W. Rev. Washington, D.C.*, 47 (1919), p. 303.

falling mainly in the winter half-year. The heaviest fall in any one year has been 241·3 inches. At the neighbouring station of Hermsburg 57·1 inches fell in October, 1889. The corresponding figures for the British Isles are :—computed annual average at Llyn Llydaw, Snowdon, 178 inches ; heaviest fall in any one year 247 inches in 1909 ; and the most in one month 56·5 inches in October, 1909.

Australia appears to be the driest of the continents, the wettest station, Harvey Creek, on the north-east coast of Queensland, having an annual average of only 165·6 inches, of which 32·2 inches fall in March (16-year average). In 1921 the fall totalled 254·8 inches.

A useful table of the greatest rainfalls in 24 hours is given in the *Monthly Weather Review*.* The following amounts of over 30 inches are included :—

| | inches. | |
|---|---|---|
| Baguio, Philippine Islands .. | 46·0 .. | June 14-15, 1911. |
| Cherrapunji, India .. .. | 40·8 .. | June 14, 1876. |
| Honomu, Hawaii .. .. | 31·9 .. | Feb. 20, 1918. |
| Nedunkem, Ceylon .. .. | 31·8 .. | Dec. 15-16, 1897. |
| Silver Hill, Jamaica .. .. | 30·5 .. | Nov. 6, 1909. |

(114·5 inches fell in five days and 135 inches in eight days).

From other sources we have the following amounts :—

| | inches. | |
|---|---|---|
| Funkiko, Japan .. .. .. | 40·7 .. | Aug. 31, 1911 and July 20, 1913. |
| ~~Beerwah~~ Cromhurst, Queensland .. .. | 35·7 .. | Feb. 2, 1893. |
| (77·3 inches in four days) | | (*Met. Zs.*, 10, 1893, *p.* 150) |
| Tanabe, Japan .. .. .. | 35·5 .. | Aug. 19-20, 1889. |
| | | (*Met. Zs.*, 7, 1890, *p.* 283) |

(this amount fell in 16 hours ; 14·25 inches fell in four hours or 3·75 inches per hour.)

| | inches. | |
|---|---|---|
| Port Douglas, Queensland .. | 31·53 .. | April, 1st, 1911. |

The fall of 40 inches in 24 hours in Queensland given in the *Monthly Weather Review* cannot be substantiated.

| | inches. | |
|---|---|---|
| Riposto, Sicily .. .. .. | 18·3 .. | Nov. 17, 1910. |

(The largest known fall in 24 hours in Europe, with the doubtful exceptions of two falls, quoted in the *Monthly Weather Review*, 1919, p. 302, reference *Encyclopedia Britannica*. These falls are given as 30 inches at Genoa and 33 inches at Gibraltar, both in 26 hours, but as no other information can be found they must be distrusted).

* Vol. 47 (1919), p. 302.

From the *Indian Meteorological Memoirs*,* we obtain the following records of 30 inches or more in 24 hours:—

| | | | |
|---|---|---|---|
| *United Provinces* .. .. | Nagina, | 32·4 | inches. |
| | Danipur, | 30·4 | ,, |
| *Bengal* .. .. .. .. | Purnea, | 35·0 | ,, |
| *Eastern Bengal and Assam* .. | Jowai, | 40·1 | ,, |
| | | (September 11, 1877). | |
| *Central India* .. .. .. | Rewah, | 30·4 | inches |

The heaviest known fall in a short period occurred on May 1, 1908, at Porto Bello, where an autographic rain gauge recorded 2·47 inches in three minutes. Such records, however, depend on the presence of autographic instruments, and many heavy falls in a few minutes at places without these instruments must escape record.

According to Hellman (*Grenzwerte der Klimaelemente auf der Erde*) the greatest frequency of rain days occurs at Jaluit (Marshall Islands), the three years 1893 to 1895 having an average frequency of 336 days with rain (including "trace"), and 265 days with 1 mm. or more. Islota de los Evangelistas, to the west of Magellan Strait, averages 317 days (1899-1909, 1912-13), Porto Bello, Nicaragua 310 days, Orange Bay near Cape Horn 306, and Kerguelen 303.

The question, which place has the smallest rainfall, resolves itself into the question "is there any place entirely without rainfall?" Hellman believes that there is not: "Even in the driest desert regions it very occasionally rains, and the remark frequently made by the oldest inhabitants that in their locality it has never yet rained, is often enough disproved by scientific travellers....There are, however, certainly places, in which in isolated years or even in several successive years no measureable rain falls. On the dry coasts of Chile and Peru, in south-west Africa, in Upper Egypt, in Australia, such cases are repeatedly determined. Formerly the Nile region at and above Assuan was considered to be quite rainless, but since a regular meteorological network has been established in Egypt, small rainfalls have often been recorded. Thus in Wadi Halfa during the ten years 1891-1900 there was no measurable rainfall, but drops of rain were observed altogether on 22 days, but not once in 1895 and 1898. In the surrounding desert there are at long intervals heavy rainstorms." On the other hand, travellers who have visited the Atacama desert have expressed the opinion that in parts of the desert it has not rained for centuries, the evidence for this being the condition of natural mummification in which bodies of some of the early Spanish explorers have been found.

C.E.P.B.

* Vol. 21, Part 3.

# The Significance of Mean Cloudiness

By F. H. Dight, B.Sc.

Publications containing summaries of meteorological data often include values of the mean cloud amount as deduced from the observations at any given station over a stated period, but any reference to the frequency of "overcast" or "clear" days is often omitted. It is reasonable to expect that the frequency with which days of either of these types occur should stand in some relation to the mean cloud amount as observed at the station. If the relation be a simple one, then it can usefully be employed to indicate from the mean cloudiness the rather more interesting and often more useful value of the number of clear or overcast days which may reasonably be expected. It is proposed to set out below the results of an attempt to establish such a relation between the two quantities.

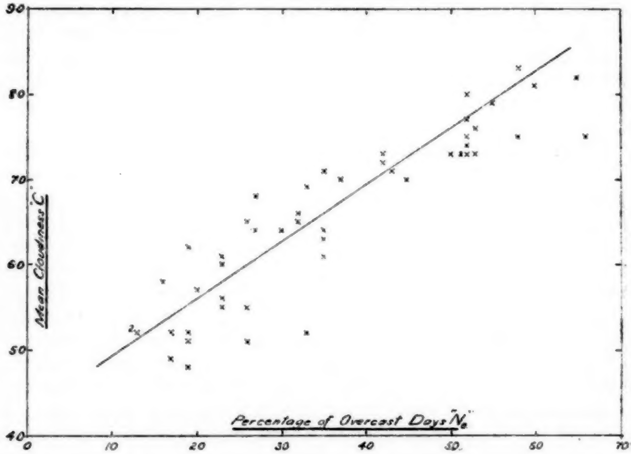


Fig. 1.

For this purpose the usual definitions of a "clear" and "overcast" day have been accepted here: a day has been classed as "overcast" when the mean value of the observed cloud amounts on that day was greater then eight tenths; when the mean value was less than two tenths the day was counted as "clear." The values collected were confined to the observations from a list of thirteen stations recording three observations per day, either at 7h., 13h., and 21h., or at 9h., 15h., and 21h. continuously throughout the years 1918-1920. In addition, the observations at Kew throughout 1921 have been used.

The general scheme was to count the number of overcast and clear days in each month, and to reduce these to a monthly percentage. The mean cloud amount for the month was also taken from the mean monthly values at the three hours of observation. The symbols used are :—

$N_o$ = percentage of overcast days per month.
$N_b$ = percentage of clear days per month.
$C$ = mean monthly cloudiness.

In the first instance the values of $N_o$, $N_b$ and C were abstracted for Kew for the twelve months of the four years 1918-1921, and the figures for each year were considered separately. It was soon obvious that corresponding values of $N_o$ and C, and of $N_b$ and C, could be fairly well represented by straight lines of the form $N_o = a_o + b_oC$ and $N_b = a_b + b_bC$, giving the relation between mean cloudiness and the percentage of overcast days in the first case, and between mean cloudiness and the percentage of clear days in the second. The method of least squares was then employed for the determination of the values of the constants a and b, which gave the best representation of the relation of N with C. The values obtained for the constants are shown as under :—

| Kew | Overcast Days | | Clear Days | | Remarks on the year |
|---|---|---|---|---|---|
| | $a_o$ | $b_o$ | $a_b$ | $b_b$ | |
| 1918 | −82 | 18·0 | 44 | −5·7 | Wet year |
| 1919 | −64 | 14·9 | 46 | −5·8 | Dry year |
| 1920 | −61 | 14·6 | 32 | −4.0 | Dull, sunshine below normal |
| 1921 | −49 | 13·0 | 55 | −7·0 | Abnormally dry year |
| Mean | −64 | 15·0 | 44 | −5·6 | |

The accompanying diagrams show the complete set of forty-eight observations over the four years plotted with the curve for the mean values of a and b shown above. Fig. 1 shows the values of $N_o$ and C with the curve $N_o = 15C — 64$. Fig. 2 shows the values of $N_b$ and C with the curve $N_b = 44 — 5{\cdot}6C$.

In the second part of the investigation a similar use was made of the observations from the following list of thirteen reporting stations: Tynemouth, Yarmouth, Dungeness, South Farnborough, Holyhead, Pembroke, Portland, Falmouth and Scilly (A. stations); and Huddersfield, Oxford, Southport and Kew (B. stations). A. stations report at 7h. 13h. and 21h., and B. stations at 9h., 15h. and 21h. Separate equations were deduced from the January observations of the thirteen stations for each of the three years 1918-1920 in turn, and a similar set of six equations also obtained from the July values for the same years, giving the relation between $N_o$ and C, and $N_b$ and C. Finally,

values for the constants a and b were calculated from the complete set of observations, separately for January and July, over the whole period of three years.

The following table gives the values of the constants :—

| | Overcast | | Clear | | | Overcast | | Clear | |
|---|---|---|---|---|---|---|---|---|---|
| | $a_o$ | $b_o$ | $a_b$ | $b_b$ | | $a_o$ | $b_o$ | $a_b$ | $b_b$ |
| Jan. 1918 | −54 | 13·5 | 56 | −7·4 | July 1918 | −63 | 13·5 | 42 | −5·7 |
| Jan. 1919 | −80 | 16·5 | 30 | −3·9 | July 1919 | −60 | 13·4 | 44 | −5·8 |
| Jan. 1920 | −84 | 16·7 | 36 | −4·7 | July 1920 | −97 | 18·5 | (5.5 | −0.7) |
| Mean .. | −73 | 15·6 | 41 | −5·3 | Mean | −73 | 15·1 | 43 | −5·7 |
| Jan. 1918-20 | −69 | 15·0 | 54 | −7·2 | July 1918-20 | −70 | 15·1 | 22 | −2·6 |

There is at once noticeable a marked agreement between the different groups of curves: to the apparent agreement of the three mean curves reference is made later. For the present it is necessary to call attention to the three most divergent values of the constants. Referring back to the Kew equations for 1921, it appears that they reflect the extended dry bright summer of that year, and this is particularly noticeable in the clear day relation. Of the four years 1918-1921, the lowest value of the mean cloud, the smallest number of overcast days, and the highest number of clear days are all credited to 1921. In September and October the high total of 15 clear days was recorded, and, of these, 9 occurred in September, bringing the total for the year to 41, against 17 in the previous year. A low figure for the mean cloudiness during these months was, however, counterbalanced to an appreciable extent by a very high value for January, so that the yearly mean was not exceptionally low.

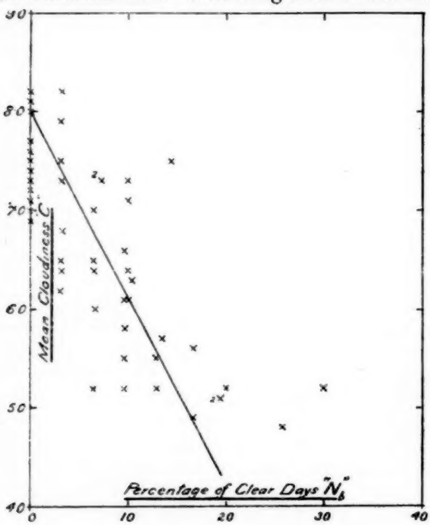


FIG. II.

The attempt to derive a clear day relation for July, 1920,

appears to be a complete failure. This is due to the fact that Dungeness was the only station to report a clear day, and the total reported from the thirteen stations for the month was one. Obviously, the equation can have no value, and was omitted when the mean value was required. There was a noticeable tendency in all the sets of observations for Dungeness to experience a smaller number of overcast days than any other station both during January and July, while in January the number of clear days was usually in excess. The total number of clear days at Dungeness recorded throughout January for the years 1918-1920 was 13, compared with the next highest figure of 9 at Falmouth, and it was found that the slope of the most representative clear day curve for January for the complete period 1918-1920 was due entirely to this high percentage of clear days at Dungeness. This explains why the difference between this curve and the mean curve of the 1918 and 1919 equations is so marked.

The position of the curves with reference to the axes might be anticipated to some extent when it is remembered that the number of overcast or clear days was not decided by a cloudiness of 10 or 0, as the case may be, but by the combination of individual cloud amounts ranging between 7 and 10, and 0 and 3 (*e.g.*, three cloud amounts of 10, 10, 7 count as an overcast day).

Some interesting equations result from a combination of the corresponding overcast and clear equations—we obtain

$$C = 5{\cdot}5 + \frac{N_o - N_b}{22{\cdot}2} \text{ for January,}$$

$$C = 5{\cdot}4 + \frac{N_o - N_b}{20{\cdot}8} \text{ for July,}$$

$$\text{and } C = 5{\cdot}2 + \frac{N_o - N_b}{20{\cdot}6} \text{ for the four years at Kew.}$$

If we put $N_o$ and $N_b$ both equal to 0 in these equations, the mean cloudiness comes out above 5·0 in all cases, indicating that there is a considerable frequency of days of mean cloudiness between six and seven tenths, or even more, which produce no overcast days. These equations may usefully be employed in checking cloud observations: errors in the number of overcast and clear days are unlikely, so that these reliable values can then be used to check the more uncertain observations of the partially cloudy days as revealed by the mean cloudiness, particularly where the error is consistently high or low. A table is given below in which are shown the actual and calculated values of C, using the above formulæ. The Kew equation has been used to find C for the year, as well as to determine a few of the monthly values. The seasonal equations have been used to give the monthly figure for a few of the stations already enumerated, and finally the method was applied to some other stations. The observations were

selected at random, and it is not proposed to discuss the figures, except to point out that Southport for July, 1920, and Plymouth for January, 1918, gave the largest discrepancies, and the formula appears to be accurate to 0·5 tenths of cloud.

| Place & Year | C (calculated) | C (actual) | Place & Month | C (calculated) | C (actual) |
|---|---|---|---|---|---|
| Kew, 1919 | 6·5 | 6·5 | Holyhead, Jan. 1920 | 6·5 | 6·8 |
| ,, 1921 | 6·2 | 6·3 | Southport, July 1920 | 8·6 | 8·1 |
| ,, Dec. 1918 | 7·7 | 7·4 | Plymouth, Jan. 1918 | 6·5 | 7·0 |
| ,, Sep. 1921 | 5·3 | 5·2 | Ross, July 1919 | 7·5 | 7·6 |
| Huddersfield, July 1918 | 6·2 | 6·3 | Spurn Head, Jan. 1920 | 6·4 | 6·8 |

The similarity of the constants a and b in the mean equations, and the agreement between the combined equations, make it seem probable that they are in close agreement with some values of a and b, which may prove, on further investigation, to give a general equation applicable to the British Isles irrespective of season.

## Discussions at the Meteorological Office

January 31st, 1927. *The way of the wind.* By W. J. Humphreys (Philadelphia, Pa., J. Franklin Inst. 200, 1925, pp 279-304). *Opener*—Mr. M. J. Thomas, B.Sc.

The paper deals with the variation of wind with height due to the facts that the earth is a rotating sphere and the air a viscous fluid. Referring to frictionless movements of the air, gradient for gradient, the maximum possible wind in an anticyclone is exactly twice that of a straight-away wind (straight isobars).

The effect of atmospheric turbulence on the direction and velocity of wind in the lower atmosphere is considered, and the equations of Ekman's Oceanographic Paper* converted to solve for straight-away winds instead of, as Ekman's paper demanded, down into the water for ocean drift. Assuming the density of the air, the pressure gradient, and the coefficient of eddy viscosity to be constant with height, the drift of air just above the surface is 45° to the right of the direction of surface movement relative to the air in the northern hemisphere, and the projection of the drift envelope on to the earth is an equiangular 45° or 135° spiral about the initial point of contact of air and surface.

The surface wind attains gradient speed both below and above the level at which the gradient direction is attained. Observa-

* "On the influence of the earth's rotation on ocean currents." By V. W. Ekman., Ark. Matem., Stockholm 2 (1905), No. 11.

tions in U.S.A. show that on many occasions (all morning conditions) a well-defined maximum velocity occurs at ½ km., and a well-pronounced minimum velocity at 1 km., the latter fact being due to the superposition of different wind systems.

The curve showing average wind velocities with height is similar to that obtained if there were no cyclonic, anticyclonic or other disturbances except turbulence in the flow of the air.

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The subjects for discussion for the next meetings will be :—

February 28th. *Studies concerning the relation between the activity of the sun and of the earth's magnetism.* By L. A. Bauer and G. A. Duvall (Terr. Mag. 30 (1923), pp. 191-213 and 31 (1926), pp. 37-47). *Opener*—Mr. W. M. Witchell, B.Sc.

March 14th. *Les méthodes de prévision du temps.* By J. Rouch (Paris, 1924), (reviewed in the *Q.J.R. Meteor. Soc.* 50, 1924, p. 390). *Opener*—Mr. J. J. Somerville, B.A., B.L.

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## Royal Meteorological Society

The annual general meeting of the Royal Meteorological Society was held on Wednesday, January 19th, when Sir Gilbert Walker was re-elected president. The Buchan Prize, which is awarded biennially for the most important original papers contributed to the Society during the previous four years, was presented to Mr. C. K. M. Douglas. Sir Gilbert Walker delivered an address on "The Atlantic Ocean," in the course of which he directed attention to the value, when studying the movements of the atmosphere, of an understanding of oceanic circulations. He described the conditions of temperature, salinity, and density revealed by recent measurements in the Atlantic down to a depth of 10,000 feet or more. These throw light on the general character of the oceanic circulation, and indicate that though prevailing winds may set up surface currents, they probably produce no significant effect at a depth exceeding 700 feet. Icy water from the Arctic, and especially the Antarctic, flows towards and even beyond the equator at great depths, and as the air temperature is largely controlled by that of the sea, variations in the general circulation may provide the explanation of some of the big seasonal changes which occur in equatorial as well as in temperate regions.

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# Correspondence

To the Editor, *The Meteorological Magazine*

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## The Solar Halo of December 5th

There was an unusual solar halo yesterday first noticed near Brompton Cemetery at 10.40 a.m. and all over by 10.50 a.m. Round the sun and touching it was a broad circle of rusty

flame-coloured radiations, similar to what is commonly called a "watery moon," but much brighter. The outer diameter of this was about 9 times that of the sun's disc. Outside came a ring of clear sky two such diameters wide and beyond that a coloured circle of the same width as the clear ring, shewing two colours, viz. :—green (inside) and red (outside), far more brilliant than the others. A dark snow-cloud drifting along from the east obliterated the inner halo, while the outer one lost its green and red, but was still traceable on the west side by broken patches of vivid blue and pale yellow.

W. P. HASKETT-SMITH.

*United University Club, Pall Mall East. December 6th, 1926.*

## Remarkably Long-lived Lunar Rainbow

For a full half-hour on the evening of November 23rd—from 8.30 to 9 o'clock—a remarkably fine and long-lived lunar rainbow was observed at Guernsey. The long shower that brought it into being began to fall just after 8 o'clock, at which hour the moon, clouded over, was but recently risen in the east-north-east. At 8.30 it emerged into a broad expanse of clear sky and the bow began forming in the northwest against an inky-dark cloud which covered more than half of the sky. Five minutes later the arc, of very large size, was complete and strikingly bright.

The remarkable feature about this moon-bow was that owing to the shower-cloud spreading eastwards very slowly (a dead calm prevailed) and the moon being low in the sky, the bow continued visible in its complete form until 9 o'clock when, our satellite at last becoming obscured, it disappeared quickly. Throughout its visibility the bow remained of a milky-white colour; no prismatic colours were observed at Les Blanches.

BASIL T. ROWSWELL.

*Les Blanches, St. Martin's, Guernsey. December 21st, 1926.*

## The Detonating Meteor of October 2nd, 1926

In an interesting account of the detonating meteor of 1926, October 2nd, Mr. F. J. W. Whipple gives to A. Wegener credit for the idea that the detonations of fireballs and meteorites are due to the passing by of a projectile bow-wave. Wegener's papers on the Treysa meteorite of 1916, April 3rd, are very stimulating and suggestive; but the credit for this particular idea belongs to B. Doss. He published it with substantial evidence, based on E. Mach's photographic studies of projectiles and on other observations made on the target range, in a paper on the meteorite of Misshof, Neues Jahrbuch für Mineralogie usw., 1892 I., pp. 71-113. His statement of conclusions is:

"that the report, like that of a cannon, which is so often heard, is nothing other than the sound head-wave . . . which initially travels with the same speed as the stone, and only begins to escape forward at that moment when the meteorite, by air-wave formation, by the production of air-vortices behind and by the friction of the air . . . has reached a velocity below the normal velocity of sound for the elevations in question." In an appended letter Mach expresses his agreement.

Perhaps the most interesting physical suggestion in Wegener's paper is, that the "disappearance" of a detonating fireball, or the ending of the luminous path of a stone-dropping meteor, coincides with this forward escape of the sound head-wave; and that, consequently, the velocity of a fireball at the moment of disappearance is the same for all. He thinks that this is somewhat above the normal velocity of a free sound-wave.

WILLARD J. FISHER.

*Harvard College Observatory, Cambridge, Massachusetts, January 9th,* 1927.

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I am much obliged to Mr. Fisher for the reference to Doss's paper. It is remarkable that a theory published in 1892 has taken so long to become generally known.

With regard to Wegener's paper it should be noted that his suggestion* is that the meteor disappears from sight when the speed is reduced to 1,000 or 1,200 metres per second, the initial speed of an explosive wave. This is no less than three times the "normal velocity of a free sound wave." Wegener supposed that reduction of velocity to that of an explosive wave was the cause of disappearance of all meteors. This is, however, inconsistent with the analysis of Lindemann and Dobson, who demonstrate† that in the case of shooting stars no material deceleration will take place until 19/20ths of the mass has evaporated. According to these authors the shooting star disappears because it has been vaporised.

F. J. W. WHIPPLE.

*Kew Observatory, Richmond. February 1st,* 1927.

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## Extremes of Temperature

I read the article on "Extremes of Temperature" in the August number of the *Meteorological Magazine* with much interest. Hitherto I believed that the Braemar figure of $-17°$ F. in February, 1895, was the lowest recorded temperature in the British Isles, but I see the even lower figure of $-23°$ F. is given by Mr. Marriott as occurring at Blackadder in December, 1879. Is this minimum fully authenticated and accepted as a record,

* *Marburg, Schr. Ges. Natw.* 14 (1917), *p.* 71.
† *London, Proc. R. Soc.* 102 (1923), *p.* 419.

and are there any other minima recorded between $-17°$ F. and $-23°$ F ?

It would also be interesting to know the highest minimum and lowest maximum recorded in Great Britain. I believe there have been some very high minima in recent summers. As to low minima, I remember there was an exceptional frost in Scotland a few years back in which maxima of 10° F. and 12° F were recorded at Balmoral and Braemar.

Another interesting question is—what is the lowest temperature at which snow has fallen at or about sea level in Great Britain ? I have a distinct recollection of a fall of snow near London in February, 1895, with the temperature at 12° F.

H. LANGFORD LEWIS.

*5, New Square, Lincoln's Inn, London, November 2nd, 1926.*

[Mr. P. I. Mulholland has kindly supplied the following notes :—

The authenticity of the minimum of $-23°$ F. at Blackadder in December, 1879, is supported by the readings recorded at neighbouring stations. I can find no record amongst the publications of the Meteorological Office or in the issues of he *Quarterly Journal of the Royal Meteorological Society* of minima between $-17°$ F. and $-23°$ F.

With regard to high minima and low maxima, a table showing the warmest night and the coldest day at several stations in the British Isles has been published regularly in the *Monthly Weather Report, Annual Summary* since 1913. The following data have been extracted from those tables :—

| | Coldest Day Period 1913—1925 | | | Warmest Night Period 1913—1926 | | |
|---|---|---|---|---|---|---|
| | Temp. | Place | Date | Temp. | Place | Date |
| | °F | | | °F. | | |
| England and Wales | 20 | Cheltenham | Feb. 7th, 1917 | 72 | Ventnor | July 13th, 1923 |
| Scotland | 10 | Balmoral | Nov. 14th, 1919 | 69 | Rothesay | July 14th, 1926 |
| Ireland | 25 | Clongowes Wood (Kildare) | Jan. 16th, 1917 | 66 | Cahir | Sept. 18th, 1915 |
| | | | | 66 | Armagh | July 9th, 1921 |
| | | | | 66 | Dublin | July 8th, 1921 |
| | | | | 66 | Ballinacurra | July 23rd, 1921 |
| | | | | 66 | Kilkenny | Aug. 9th, 1923 |
| | | | | 66 | Dublin, Kilkenny | July 12th, 1926 |

In a paper in the *Quarterly Journal** by the late W. Marriott entitled, " The frost of December, 1879, over the British Isles," there is a record of a maximum temperature at Appleby of 12·4° F. on December 7th.

With regard to the lowest temperature recorded during a fall of snow, it is difficult to get precise information. January, 1881, was a month of frequent and severe snowstorms ; in *Hourly*

**London Q.J.R. Meteor. Soc., 6 (1880), p. 102.*

*Readings* for January, 1881, the total amount of precipitation in the form of melted snow for Stonyhurst for the 24 hours ending at 10h. on January 16th is given as 0·063 in. and the lowest temperature during the same 24 hours as 7° F. (approximately). The maximum for the same period was 28·3° F. It is, however, impossible to say whether the snow was actually falling continuously during this period.

During the snowstorm of December 29th, 1908, the temperature at Richmond varied from 27·1° F. at 2 a.m. to 21·9° F. in the afternoon, and at Aberdeen from 27·7° F. at midnight to 30·7° F. in the afternoon.]

## Dr. Hirth's Isonotides

The isonotides referred to in the October *Meteorological Magazine* are in my opinion wholly misleading if interpreted, as such lines of equal " moisture " may easily be, in any other sense than the restricted one mentioned by Dr. Hirth, namely, as an index of the necessity or otherwise for irrigation in different parts of the world. The physiological idea of " dryness " or " dampness " in climate is highly composite, comprising amount and frequency of rain, density and frequency of fog, state of soil and vapour pressure. The best numerical expression for this totality of influence is not the relation of rainfall to temperature, but the ratio of rainfall to evaporation—by no means the same thing, unless one gets down to detail. When Dr. Hirth's map is studied, there will be found the anomaly that whereas regions like Siberia and Canada, which are generally regarded as possessing a physiologically dry winter climate with dry crisp snow and low vapour pressure, are placed in the dampest climatic category, England, or the bulk of it, with an unmistakably damp type of winter climate as indicated by much higher vapour pressure, sodden soil and common alternatives of rain, fog and wet snow, goes in a drier category. The summer conditions differ less in the two types of climate, and do not matter in the present argument. The anomaly in question, as well as others which could be mentioned, shows that Dr. Hirth's " rain factors," on which his isonotides are based, cannot be used as a general expression for climatic " dampness," which is in reality an exceedingly complex condition.

L. C. W. Bonacina.

*27, Tanza Road, Hampstead. October 25th*, 1926.

[The discrepancy to which Mr. Bonacina refers, namely, that on Dr. Hirth's map the " rain factor " for the greater part of England is between 61 and 100, while that for central Siberia is above 100, is due to the low mean annual temperatures of Siberia, which are dominated by the extremely low temperatures of winter. For most practical purposes, so long as the maximum

temperature is below freezing point for a long period, it makes little difference whether the winter mean is $-10°$ C. or $-40°$ C., but it makes a great difference to the mean annual temperature, and in such regions the latter has very little significance, so that the "rain-factor" should be limited to those regions in which the mean temperature of the coldest month is above 0° C. With this limitation the chart does seem to be of value, as is shown at once by a comparison with a map of areas of desert, grassland and forest. A chart of the ratio of rainfall to evaporation would doubtless be more satisfactory if only we could obtain comparable measures of evaporation from a sufficient number of stations. We regret that in the article on p. 214 of the October Magazine the name Hirth was given as Wirth.—ED. *M.M.*]

## NOTES AND QUERIES

### Heavy Rainfall in the Cameroons

The Surveyor-General for Nigeria has contributed some interesting figures as to the rainfall at Debundscha (latitude 4° 6′ N, longitude 8° 59′ E), which is situated practically at sea level, at the foot of the Cameroon Mountain, and 15 miles to the south-west of the peak, which rises to an altitude of 13,300 feet. The records were obtained by the manager of the Debundscha Plantation, with a raingauge of 113 mm. diameter.

For the fifteen years 1911 to 1925 the average fall was 369·2 inches, the annual totals ranging from 204·3 inches in 1924 to 572·3 inches in 1919. For the latter year the following details are given as to the rainfall in the individual months :—

| Month | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amount (inches) | 17·0 | 9·8 | 18·5 | 19·5 | 47.5 | 58·3 | 68·3 | 109·9 | 90·7 | 89·9 | 35·1 | 13·2 |
| No. of Days | 19 | 19 | 23 | 26 | 29 | 28 | 29 | 31 | 28 | 29 | 19 | 15 |
| Highest in Day (inches) | 5·1 | 3·3 | 2·6 | 2·6 | 10·0 | 11·9 | 7·5 | 11·0 | 9·9 | 11·4 | 7.5 | 3·3 |

In 1925, with an annual total of 353·2 inches, the monthly falls ranged from nil in January, to 65·1 inches in September. The average number of raindays in a year (1912, 1914-1925) is 267, so that it rains on nearly three days out of four, but, even so, the average amount in a day is nearly 1·4 inches. The maximum fall in a day was 14·6 inches in June, 1911, while in August, 1919, an average of 3·5 inches fell on every day of the month.

The prevailing winds at Debundscha are from west and south-west throughout the year, that is, they blow directly onshore and up the slopes of the mountain. The difference between the wet season in June to October and the "dry" season in December to

April, is probably due to two factors. In the northern summer, owing to the greater height of the sun, the equatorial belt of instability moves northwards, so that the air crossing the coastline is able to rise up the slopes of the mountain instead of tending to flow round it as in the northern winter, when the sun is far to the south. But probably the previous history of the air also plays some part in the annual variation of rainfall: in the northern winter the air is derived from the north-east current over west Africa, which has curved round over the Gulf of Guinea and has, therefore, travelled for a comparatively short distance over the ocean, while in the northern summer the prevailing winds over this part of the Atlantic Ocean are derived from the south-east trade wind, which has become a south-west wind after crossing the equator, and has, therefore, travelled over the water surface for a long distance and acquired a high degree of humidity. The large totals are, of course, amply accounted for by the onshore winds and the high steep slopes of the mountains: it would be interesting to know what the rainfall is further up the slopes.

## Damage by a Cyclone, Mauritius

An account of a cyclone which passed near Mauritius on April 19th and damaged the crops there, has been received from Mauritius Observatory by the courtesy of the Colonial Office. The cyclone moved at about 5 or 6 miles per hour on a south-southwesterly track, the centre passing at a minimum distance of about 50 miles from the island between 16h. and 18h. Squalls of 58 miles per hour were recorded at Pamplemousses between 6h. and 7h., and of 61 m.p.h. at Vacoas between 11h. and 12h. The weather conditions had been exceptionally favourable for the sugar crop up to the 19th, but afterwards there was drought and a considerable fall of temperature, so that the reduction in the crop, estimated at 15 per cent. on account of the cyclone, is likely to be increased.

## The Florida Hurricane

The Editor of the *Monthly Weather Review* calls our attention to an error on page 208 of the October number of this Magazine in the sentence beginning " At Palm Beach " and ending " Lake Okeechobee," in the account of the Florida Hurricane. He says: " Lake Okeechobee, as is doubtless known, is 30-35 miles inland from Palm Beach. On the southwest shore of the lake a town known as Moore Haven has grown up in quite recent years. The level of the town is about 5 feet below that of the surface of the lake and is protected therefrom by a dyke. What happened was this: The northeast winds of the hurricane piled the waters up on the southwest shore of the lake, the dyke gave

way and the people in the town were drowned. We are still waiting for a revised list of the loss of life in connection with the storm."

## Extremes of Rainfall over the British Isles

Extremes of rainfall can be considered for the various units of time, *e.g.*, the year, month, day, and even for shorter periods. In the case of the month and year, the distribution of the extreme values is largely controlled by the configuration of the land, while for shorter periods the largest values on record occur in the drier regions of central England, where convectional rains are more common. The extremes set out below cover records for the last sixty years which have been discussed in the annual volumes of British Rainfall. During this period the number of stations has increased from about 1,000 to 5,000. The stations are not evenly distributed over the British Isles, the more mountainous regions being but sparsely represented.

The wettest year over the British Isles as a whole was 1872 with 137 per cent. of the average, and the driest year, 1887 with 77 per cent.

The average annual rainfall exceeds 150 inches in the English Lake District, Snowdonia and the western Highlands of Scotland, while the annual rainfall is less than 20 inches in the Thames Estuary. Annual totals exceeding 240 inches were recorded at The Stye, at the head of Borrowdale in Cumberland, in 1872 and 1923, at Ben Nevis Observatory, in Inverness, in 1898, and at Llyn Llydaw on Snowdon in 1909. The rainfall in 1921 in the south-east of England was easily the smallest on record, as little as 10 inches being recorded at Margate.

The wettest month over the British Isles as a whole was December, 1876, and the driest months, June, 1925, and February, 1891. The largest actual values at individual stations are set out below :—

| Station | County | Month | Amount Inches |
|---|---|---|---|
| Snowdon (Llyn Llydaw) .. | Carnarvon .. | October 1909 .. | 56·54 |
| Borrowdale (The Stye) .. | Cumberland .. | January 1872 .. | 50·05 |
| Ben Nevis Observatory .. | Inverness .. | December 1900 .. | 48·34 |

Several stations recorded no rain in February, 1891, July, 1911, June, 1921, and June, 1925. Such records occurred in the south-eastern portions of England, and of Wales, Scotland and Ireland, In February, 1891, some 270 stations situated in central and south-east England measured no rain for the month, while in June 1925, no rain was recorded over an area of 6,410 square miles, or an area equal to about 85 per cent. of the total area of Wales.

The distribution of the extreme annual values is very largely controlled by the configuration of the land, the largest values

occurring in the mountainous regions, and the smallest on the plains. The distribution of the monthly extremes reveals a second factor, viz., that the south-east of England is more liable to periods of little or no rain, while in the north-west rain falls more frequently. Thus, at Eallabus, in Islay, on the west coast of Scotland, rain fell every day from August 12th to November 8th, 1923, a period of 89 days, or nearly three months, the average annual rainfall at Eallabus being only about 50 inches a year. This second factor is shown very clearly in monthly and annual maps of the number of days with rain. They indicate that in general there is a steady increase in the number of days with rain from the south-east to north-west, even at stations with the same annual fall. The least number of days recorded in any year was in 1921, when there was less than 100 days of rain over a well-marked area in the neighbourhood of the Thames Estuary. In 1923 the north-west of Ireland had more than 300 days with rain, and Ballynahinch Castle, in Connemara, recorded 309 rain days in the same year.

It is of interest to consider the longest periods on record in these islands with no rain. In 1893, during the famous spring drought, some 20 stations in the south-east of England, mostly in Kent and Sussex, recorded no rain for a period of 50 days or more. Locally in this district there was a two months' drought from March 17th to May 16th. The year 1893 was unprecedented for periods of little or no rain.

The largest falls on record for one day (9h. to 9h.) are set out below :—

| County | Station | Amount Inches | Date |
|---|---|---|---|
| Somerset .. | Bruton (Sexey's School) .. .. | 9.56 .. | June 28th 1917. |
| ,, .. | Cannington (Brymore House) .. | 9.40 .. | Aug. 18th 1924. |
| ,, .. | Bruton (King's School) .. .. | 8.48 .. | June 28th 1917. |
| ,, .. | Aisholt (Timbercombe) .. .. | 8.39 .. | June 28th 1917. |
| Inverness .. | Loch Quoich (Kinlochquoich) .. | 8.20 .. | Oct. 11th 1916. |
| Cumberland | Borrowdale (Seathwaite) .. .. | 8.03 .. | Nov. 12th 1897. |

The average annual rainfall for the first four stations is 30 to 35 inches, while that for the fifth and sixth stations exceeds 100 inches; so that with the short interval of the day the controlling influence of configuration over the distribution of extreme values has practically disappeared.

The most widespread heavy rain on record occurred in East Anglia on August 25th and 26th, 1912, when 1,939 square miles received more than 4 inches, corresponding to a volume of rainfall of 154,133 million gallons.

Of the list of heavy falls in short periods, it is only possible to quote a few examples. The fall of 1·25 inches in five minutes reported at Preston in Lancashire, on August 10th, 1893, gives the largest rate on record, viz., 15 inches per hour. The largest

fall in half an hour is 2·90 inches recorded at Cowbridge in Glamorganshire on July 22nd, 1880, and in one hour that of 3·63 inches at Maidenhead, on July 2nd, 1913. The heavy rain of 4·65 inches in two and a half hours on June 16th, 1917, at Campden Hill, in west London, is worthy of mention, since this amount is the largest on record for London for a rainfall day. It has been estimated that during the unprecedented storm at Cannington, near Bridgwater, on the August 18th, 1924, as much as 8 inches of rain (and hail) fell in 5 hours.

The largest values occur in the south and east of Great Britain and of Ireland, and the distribution of these heavy falls in short periods appears to be quite independent of the configuration.

J.G.

## Radiation from the Sky

RADIATION MEASURED AT BENSON, OXON, 1926.

*Unit: one gramme calorie per square centimetre per day.*

| ATMOSPHERIC RADIATION only (dark heat rays) Averages for Readings | | | | |
|---|---|---|---|---|
| | | Oct. | Nov. | Dec. |
| Cloudless days :— | | | | |
| Number of readings ... ... | $n$ | 4 | 6 | 6 |
| Radiation from sky in zenith ... | $\pi I$ | 437 | 440 | 420 |
| Total radiation from sky ... | J | 470 | 467 | 446 |
| Total radiation from horizontal black surface on earth ... | X | 690 | 673 | 652 |
| Net radiation from earth ... | X—J | 220 | 206 | 206 |
| **DIFFUSE SOLAR RADIATION (luminous rays). Averages for Readings between 9 h. and 15 h. G.M.T.** | | | | |
| Cloudless days :— | | | | |
| Number of readings ... ... | $n_0$ | 1 | 3 | 3 |
| Radiation from sky in zenith ... | $\pi I_0$ | 52 | 15 | 14 |
| Total radiation from sky ... | $J_0$ | 69 | 24 | 18 |
| Cloudy days :— | | | | |
| Number of readings ... ... | $n_1$ | 3 | 2 | 8 |
| Radiation from sky in zenith ... | $\pi I_1$ | 185 | 61 | 24 |
| Total radiation from sky ... | $J_1$ | 165 | 51 | 21 |

Unit for I = gramme calorie per day per steradian per square centimetre.

Unit for J and X = gramme calorie per day per square centimetre.

For description of instrument and methods of observation, see *The Meteorological Magazine*, October, 1920, and May, 1921.

# Obituary

*Professor Alfred de Quervain.*—We regret to learn of the death on January 13th, at Zürich, of Professor de Quervain, at the comparatively early age of 47. Professor de Quervain was born on June 15th, 1879, in the Canton of Berne. He was educated at Neuchatel and Berne, and from 1898 until 1902 he assisted the late Teisserenc de Bort, at the Observatory at Trappes, in developing the exploration of the upper air by means of ballons-sondes. As a result of these researches the stratosphere was discovered in 1899. In 1901 de Quervain carried out ascents in Russia, obtaining observations of temperature up to 10 kilometres. From Trappes he went to Strasbourg, where he worked with Professor Hergesell and also acted as Secretary to the International Commission for Scientific Aeronautics. To overcome the difficulty of following balloons for long periods with an ordinary theodolite, he invented the theodolite with the reflecting prism, now generally adopted.

From Strasbourg Professor de Quervain returned to Zürich. In 1909 he was in Greenland as the leader of a joint German-Swiss expedition, and three years later he led a Swiss expedition which successfully crossed the inland ice from west to east, ending at Angmagsalik where he was met by his wife. A short crossing near the southern extremity of the ice had been made by Nansen in 1888, but de Quervain was the first to traverse the real interior of Greenland, covering more than 400 miles and reaching a height of 8,200 feet. The scientific results of the expedition, discussed by de Quervain and Mercanton, are still the main source of our knowledge of the meteorology of the Greenland ice-sheet.

After the war, when the International Meteorological Committee met again to take up the difficult post-war problems of the international exchange of observations, de Quervain became a member of the Commission for Meteorological Telegraphy. He was also keenly interested in the establishment of an Observatory on the Jungfraujoch at a height of 3,500 metres, in which he enlisted the warm support of his colleagues. Owing to his unique knowledge of clouds he was elected Chairman of the Sub-Commission appointed in 1923 to consider the method of reporting observations of cloud and weather in the International code, but in 1924, before this task was completed, his health broke down. He never quite recovered, though he was able to be present at a meeting at Zürich in September, 1926, at which the Commission approved a new trial code based on his work, and expressed its warm appreciation of his services and its sympathy with him in his illness. His death so soon afterwards was quite unexpected.

*Mr. Charles Harding.*—The death of Mr. Charles Harding, which was announced in the January number, has removed from our midst the last of those who worked in the office under Admiral Fitzroy. Mr. Harding entered the Meteorological Department of the Board of Trade in 1861 as a boy of fifteen and did not finally retire until 1920. His active connexion with the office thus extended over very nearly sixty years. In the reconstruction in 1867 following on Fitzroy's death, Harding elected to remain with the office rather than accept service under the Board of Trade as a clerical officer. I believe I am right in saying that throughout his career he was engaged in the Marine Division, for over thirty years he was its Principal Assistant. He retired in 1911, but returned for part time duty during the war, and as has been already mentioned, remained on the active staff until 1920. The Harding family was closely associated with the office in its early days. The elder brother, James, was Chief Clerk for many years, and the father was also in its service.

In his younger days Charles Harding demonstrated his interest in meteorology by volunteering to take part in the ascents of manned balloons which the Meteorological Office undertook in 1880 and 1881. He made several ascents as observer, but fortunately for him he was not concerned in the fatal ascent on December 10th, 1881, in which Mr. Walter Powell, M.P., lost his life, which put an end to the active co-operation of the Office in the investigation of the upper atmosphere for many a year to come.

Harding was a Fellow of the Royal Meteorological Society and served on the Council for a number of years. He contributed a number of papers to the Society's Journal, for the most part dealing with periods of exceptional weather on the Oceans or over the British Islands, but in 1881 he had a paper in the Journal in which we find a suggestion for determining mean values over the ocean by the use of synchronous charts. That method of approaching the problem has since been used effectively by various writers. His last lengthy contribution to the Society's Journal was made in 1912 when he prepared, at the request of the Council, an account of the abnormal summer of that *annus mirabilis*, 1911.

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*Francis Campbell Bayard, LL.M.*—The death occurred on January 22nd, 1927, at the age of 75, of Mr. Campbell Bayard, barrister-at-law of the Inner Temple. Mr. Bayard was keenly interested in meteorology and maintained a climatological station at Wallington, Surrey, from 1890 until April, 1926. His rainfall observations have been published in *British Rainfall* since 1885. In 1888, when he was honorary secretary of the

committee of the Croydon Natural History and Scientific Society he accepted charge of the arrangements for observing the daily rainfall round Croydon. In that year 34 stations sent in records to the society, but during the 37 years Mr. Bayard compiled these rainfall and other meteorological records for publication each month by the society the number increased to over 100. Since 1925, when he gave up this work, the contributing observers have forwarded their results direct to the Meteorological Office.

Mr. Bayard was elected a Fellow of the Royal Meteorological Society in 1884 and served for many years on the Council, becoming Secretary in 1892 on the death of Dr. Tripe, President in 1898 and 1899, and Secretary again from 1900 to 1915. He contributed a number of papers to the Society's Journals dealing mainly with climatological subjects.

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We also regret to learn of the death of Lieut-Col. Henry Mellish, of Hodsock Priory, Notts, on February 2nd, at the age of 70.

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We regret to announce the death on January 30th, in a motor-cycling accident, of Mr. W. A. Lambert, Grade III. Clerk of the Meteorological Office, stationed at Worthy Down, Hants.

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## News in Brief

The Eighth Annual Soirée of the Meteorological Office Staff was held on Friday, February 11th, at Australia House. A programme of music, conjuring and dancing, with a sketch by the South Kensington Amateur Dramatic Society, was enjoyed by some 200 past and present members of the Staff and their friends. The Outstations were well represented.

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The sixth Annual Dinner of the Meteorological Office Staff, at Shoeburyness, was held on February 5th, at the Queen's Hotel, Westcliff. Mr. D. Brunt, Superintendent of Army Services, was the guest of the evening and a very pleasant time was spent. The musical programme consisted of instrumental and vocal solos, many of the items being original.

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## The Weather of January, 1927

Unsettled weather prevailed generally throughout January, although there were many bright intervals. Conditions at first were rather mild but after the 13th they became very wintry. During the first days of the month the winds were westerly, but on the 4th, in the rear of a depression which passed north of Scotland towards Scandinavia, they veered north, and there was a temporary drop in temperature, with snow or sleet in many

places, The mild westerly conditions were renewed on the 5th to 6th, and lasted until the 12th, when a depression deepened considerably as it approached our northwest coasts, causing widespread gales on the 12th and 13th, gusts of over 70 m.p.h. occurring in several places. During this period temperature rose as high as 58° F. at Balmoral on the 9th, and the rain, though frequent, was not heavy, except locally in Scotland, where 55mm. (2·2 in.) were measured at Achnashellach on the 2nd, and 25 mm. (1·0 in.) at Ford on the 7th. After the 13th the temperature dropped considerably, and on the 15th frost persisted throughout the day at Aberdeen. There was more than a week of cold weather with frequent sleet or snow and much fog at times. Maximum temperatures did not exceed 40° F. in the north, and the lowest night temperatures of the month, 12° F. in the screen and 8°F. on the ground, occurred on the 20th at West Linton. On the 22nd and 23rd milder weather prevailed temporarily in some parts. During the last week conditions were very rough. Reports from ships on the Atlantic on the 24th indicated an unusually deep depression, which caused gales and heavy rain on our western coasts as it moved towards Iceland. Vigorous secondaries developed further south and passed across the British Isles on the 26th to 29th. On the 28th, in particular, gales of exceptional violence were experienced in the west, when a gust of 104 m.p.h. was recorded at Paisley, of 102 m.p.h. at Renfrew, and of 92 m.p.h. at both Lerwick and Pendennis. Thunderstorms occurred in some places, and heavy rain fell in several parts of south-western England, *e.g.*, 81 mm. (3·19 in.) fell at Holne, Devon, and 63 mm. (2·47 in.) at Tynywaum, Gloucester. After this the weather cleared temporarily, and fine sunny conditions were experienced on the 31st.

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Pressure was below normal over northern and western Europe Iceland and Spitsbergen, the greatest deficit being 12·4 mb. at Wick, and above normal over Spain and Portugal and the greater part of the North Atlantic, an excess of 8·7 mb. being recorded at Horta (Azores). Temperature and rainfall were both above normal in Europe except in the north of the Scandinavian peninsula. In Sweden the rainfall was generally about twice the normal, and as much as three times the normal in Dalecarlia. At Spitsbergen temperature was above normal and rainfall below normal.

A sudden rise in temperature owing to the föhn wind took place in Switzerland on the 7th and again on the 13th, causing rain to fall up to a level of 2,500 ft. and the rivers to rise rapidly in the lower regions. In neither case did the warm period last longer than 24 hours. On the 14th it was reported that part of the Ems was flooded and that the Moselle and the Rhine (near Cologne) were rising rapidly. A heavy fall of snow occurred

on the 18th in the Lozère, the north of the Hérault, and the Haute-Auvergne, and later in the month bad weather prevailed in many parts of Italy. Floods and landslides were reported near Bologna and Palma and snow fell heavily in the foothills round Padua and Bergamo. Owing to the heavy gales a steamer sank with the loss of 15 lives at San Esteban de Pravia. Severe ice conditions were experienced on the Baltic in the middle of the month, and on the 24th and 25th an unusually thick fog lay over the Black Sea. In Transcaucasia a snowstorm did much damage on the 6th and 7th. The severe drought experienced in southern Palestine for so long was broken on the 18th when heavy rain was reported from Beersheba, Gaza, and Hebron. Floods occurred in Malaya at the beginning of the month and at the end heavy rains were again experienced in the same area.

A heat wave, said to be the severest for 15 years, swept over South Australia during the first part of the month, the temperature on five successive days being over 100° F., with a maximum in Adelaide of nearly 109° F., and in the country of 113° F. The highest temperature ever recorded at Adelaide was 116° F. in 1858. Floods due to the recent heavy rains have caused great damage to railways and bridges in Queensland.

The summer in the Transvaal has been abnormally dry and during January the drought continued. Three rivers, the Olifant, the Koedoes, and the Selati, are reported to be absolutely dry and wells and springs are failing. It is estimated that 40,000 cattle are dead.

Mild weather was experienced in the United States to the west of the Mississippi at the beginning of the month and in the south-eastern States after the 18th, but on the 26th a cold spell occurred in the eastern States causing much distress.

Gales were experienced frequently in the North Atlantic, force 10 (59 m.p.h.) being reported on the 5th, 12th, 24th, 25th, 26th, and 28th.

The special message from Brazil states that the rainfall was scarce over the whole country, being 64 mm., 133 mm. and 49 mm. below normal in the northern, central and southern districts respectively. Numerous depressions passed across the country. The cane crop in the north has suffered from the lack of rain but the crops in the centre and south are in good condition. Pressure at Rio de Janeiro was 0.1 mb. above normal and temperature 0·4° F. below normal.

## Rainfall, January—General Distribution

| | | |
|---|---|---|
| England and Wales .. | 122 | per cent. of the average 1881-1915. |
| Scotland .. .. .. .. .. | 130 | |
| Ireland .. .. .. .. .. | 132 | |
| British Isles .. .. .. .. | 126 | |

## Rainfall: January, 1927: England and Wales

| CO. | STATION. | In. | mm. | Per-cent. of Av. | CO. | STATION. | In. | mm. | Per-cent. of Av. |
|---|---|---|---|---|---|---|---|---|---|
| *Lond.* | Camden Square | 1·78 | 45 | 96 | *War.* | Birminghm, Edgbaston | 2·77 | 70 | 137 |
| *Sur.* | Reigate, The Knowle | 2·44 | 62 | 108 | *Leics* | Thornton Reservoir | 2·67 | 68 | 135 |
| *Kent.* | Tenterden, Ashenden | 2·19 | 56 | 102 | „ | Belvoir Castle | 1·72 | 44 | 97 |
| „ | Folkestone, Boro. San. | 2·51 | 64 | ... | *Rut.* | Ridlington | 1·93 | 49 | ... |
| „ | Margate, Cliftonville | 1·41 | 36 | 85 | *Linc.* | Boston, Skirbeck | 1·84 | 47 | 114 |
| „ | Sevenoaks, Speldhurst. | 2·69 | 68 | ... | „ | Lincoln, Sessions House | 1·44 | 37 | 86 |
| *Sus.* | Patching Farm | 2·34 | 59 | 90 | „ | Skegness, Marine Gdns. | 1·59 | 40 | 92 |
| „ | Brighton, Old Steyne | 1·95 | 49 | 81 | „ | Louth, Westgate | 1·50 | 38 | 69 |
| „ | Tottingworth Park | 3·02 | 77 | 112 | „ | Brigg | 1·77 | 45 | 99 |
| *Hants* | Ventnor, Roy.Nat.Hos. | 2·59 | 66 | 101 | *Notts.* | Worksop, Hodsock | ... | ... | ... |
| „ | Fordingbridge, Oaklnds | 3·10 | 79 | 112 | *Derby* | Mickleover, Clyde Ho. | 2·01 | 51 | 100 |
| „ | Ovington Rectory | 3·11 | 79 | 115 | „ | Buxton, Devon. Hos. | 4·48 | 114 | 100 |
| „ | Sherborne St. John | 2·56 | 65 | 110 | *Ches.* | Runcorn, Weston Pt. | 3·94 | 100 | 166 |
| *Berks* | Wellington College | 1·84 | 47 | 93 | „ | Nantwich, Dorfold Hall | 2·48 | 63 | ... |
| „ | Newbury, Greenham | 2·76 | 70 | 119 | *Lancs* | Manchester, Whit. Pk. | 3·57 | 91 | 142 |
| *Herts.* | Benington House | ... | ... | ... | „ | Stonyhurst College | 5·43 | 138 | 127 |
| *Bucks* | High Wycombe | 2·50 | 64 | 120 | „ | Southport, Hesketh Pk | 3·75 | 95 | 147 |
| *Oxf.* | Oxford, Mag. College | 2·26 | 57 | 131 | „ | Lancaster, Strathspey. | 4·19 | 106 | ... |
| *Nor.* | Pitsford, Sedgebrook | 2·43 | 62 | 131 | *Yorks* | Wath-upon-Dearne | 1·80 | 46 | 94 |
| „ | Oundle | 1·46 | 37 | ... | „ | Bradford, Lister Pk. | 2·99 | 76 | 104 |
| *Beds.* | Woburn, Crawley Mill. | 2·15 | 55 | 126 | „ | Oughtershaw Hall | 9·34 | 237 | ... |
| *Cam.* | Cambridge, Bot. Gdns. | 1·64 | 42 | 109 | „ | Wetherby, Ribston H. | 1·95 | 50 | 95 |
| *Essex* | Chelmsford, County Lab | 1·61 | 41 | 105 | „ | Hull, Pearson Park | 1·57 | 40 | 87 |
| „ | Lexden, Hill House | 1·42 | 36 | ... | „ | Holme-on-Spalding | 1·63 | 41 | ... |
| *Suff.* | Hawkedon Rectory | 1·52 | 39 | 87 | „ | West Witton, Ivy Ho. | ... | ... | ... |
| „ | Haughley House | ·87 | 22 | ... | „ | Felixkirk, Mt. St. John | 2·33 | 59 | 117 |
| *Norf.* | Beccles, Geldeston | 1·12 | 28 | 67 | „ | Pickering, Hungate | 2·09 | 53 | ... |
| „ | Norwich, Eaton | ... | ... | ... | „ | Scarborough | 1·71 | 43 | 85 |
| „ | Blakeney | 2·17 | 55 | 126 | „ | Middlesbrough | 1·43 | 36 | 89 |
| „ | Swaffham | 2·20 | 56 | 119 | „ | Baldersdale, Hury Res. | 2·33 | 59 | ... |
| *Wilts.* | Devizes, Highclere | 3·87 | 98 | 178 | *Durh.* | Ushaw College | 1·51 | 38 | 74 |
| „ | Bishops Cannings | 3·54 | 90 | 153 | *Nor.* | Newcastle, Town Moor. | 1·36 | 35 | 67 |
| *Dor.* | Evershot, Melbury Ho. | 3·96 | 101 | 114 | „ | Bellingham, Highgreen | 3·04 | 77 | ... |
| „ | Creech Grange | 2·57 | 65 | ... | „ | Lilburn Tower Gdns. | 1·80 | 46 | ... |
| „ | Shaftesbury, Abbey Ho. | 2·55 | 65 | 98 | *Cumb* | Geltsdale | 3·44 | 87 | ... |
| *Devon* | Plymouth, The Hoe | 4·59 | 117 | 138 | „ | Carlisle, Scaleby Hall | 3·89 | 99 | 157 |
| „ | Polapit Tamar | 8·02 | 204 | 216 | „ | Seathwaite M. | *20·00* | 508 | 151 |
| „ | Ashburton, Druid Ho. | 8·23 | 209 | 162 | *Glam.* | Cardiff, Ely P. Stn. | 4·98 | 126 | 132 |
| „ | Cullompton | 5·50 | 140 | 170 | „ | Treherbert, Tynywaun | 10·93 | 278 | ... |
| „ | Sidmouth, Sidmount | 3·48 | 89 | 122 | *Carm* | Carmarthen Friary | 5·91 | 150 | 135 |
| „ | Filleigh, Castle Hill | 8·09 | 205 | ... | „ | Llanwrda, Dolaucothy. | 8·00 | 203 | 150 |
| „ | Barnstaple, N.Dev.Ath. | 5·94 | 151 | 182 | *Pemb* | Haverfordwest, School | 4·91 | 125 | 107 |
| *Corn.* | Redruth, Trewirgie | 7·80 | 198 | 185 | *Card.* | Gogerddan | 5·28 | 134 | 129 |
| „ | Penzance, Morrab Gdn. | 6·76 | 172 | 178 | „ | Cardigan, County Sch. | 4·84 | 123 | ... |
| „ | St. Austell, Trevarna | 8·16 | 207 | 191 | *Brec.* | Crickhowell, Talymaes | 6·00 | 152 | ... |
| *Soms* | Chewton Mendip | 5·10 | 130 | 133 | *Rad.* | Birm. W.W. Tyrmynydd | 9·24 | 235 | 147 |
| „ | Street, Hind Hayes | 3·16 | 80 | ... | *Mont.* | Lake Vyrnwy | 7·99 | 203 | 142 |
| *Glos.* | Clifton College | 3·31 | 84 | 117 | *Denb.* | Llangynhafal | 3·01 | 76 | ... |
| „ | Cirencester, Gwynfa | 3·56 | 90 | 138 | *Mer.* | Dolgelly, Bryntirion | 7·26 | 184 | 128 |
| *Here.* | Ross, Birchlea | 3·38 | 86 | 140 | *Carn.* | Llandudno | 2·00 | 51 | 78 |
| „ | Ledbury, Underdown. | 3·20 | 81 | 146 | „ | Snowdon, L. Llydaw 9 | 17·87 | 454 | ... |
| *Salop* | Church Stretton | 3·17 | 81 | 125 | *Ang.* | Holyhead, Salt Island. | 3·41 | 87 | 117 |
| „ | Shifnal, Hatton Grange | 1·82 | 46 | 94 | „ | Lligwy | 2·90 | 74 | ... |
| *Staff.* | Tean, The Heath Ho. | 2·85 | 72 | 111 | *Isle of Man* | | | | |
| *Worc.* | Ombersley, Holt Lock. | 3·16 | 80 | 165 | | Douglas, Boro' Cem. | 3·79 | 96 | 113 |
| „ | Blockley, Upton Wold. | 3·43 | 87 | 146 | *Guernsey* | | | | |
| *War.* | Farnborough | 3·06 | 78 | 142 | | St. Peter P't, Grange Rd | 4·59 | 117 | 157 |

## Rainfall: January, 1927: Scotland and Ireland

| CO. | STATION | In. | mm. | Per-cent. of Av. | CO. | STATION. | In. | mm. | Per-cent. of Av. |
|---|---|---|---|---|---|---|---|---|---|
| *Wigt.* | Stoneykirk, Ardwell Ho | 4·31 | 109 | 146 | *Suth.* | Loch More, Achfary... | 12·14 | 308 | 167 |
| „ . | Pt. William, Monreith. | 4·27 | 108 | ... | *Caith* | Wick | 2·46 | 62 | 100 |
| *Kirk.* | Carsphairn, Shiel. | 11·59 | 294 | ... | *Ork.* | Pomona, Deerness | 3·99 | 101 | 116 |
| „ . | Dumfries, Cargen | 5·43 | 138 | 136 | *Shet.* | Lerwick | 6·94 | 176 | 163 |
| *Roxb* | Branxholme | 3·36 | 85 | 123 | | ——— | | | |
| *Selk.* | Ettrick Manse | 8·17 | 207 | ... | *Cork.* | Caheragh Rectory | 6·55 | 166 | ... |
| *Berk.* | Marchmont House | 2·40 | 61 | 107 | „ .. | Dunmanway Rectory. | 6·90 | 175 | 111 |
| *Hadd* | North Berwick Res. | 1·33 | 34 | 77 | „ .. | Ballinacurra | 4·06 | 103 | 102 |
| *Midl* | Edinburgh, Roy. Obs.. | 2·23 | 57 | 128 | „ .. | Glanmire, Lota Lo. ... | 5·35 | 136 | 124 |
| *Lan.* | Biggar | ... | .. | ... | *Kerry* | Valentia Obsy. | 6·10 | 155 | 111 |
| „ . | Leadhills | 9·82 | 249 | ... | „ . | Killarney Asylum | ... | .. | ... |
| *Ayr.* | Kilmarnock, Agric. C.. | 5·62 | 143 | 165 | „ . | Darrynane Abbey | 7·65 | 194 | 153 |
| „ . | Girvan, Pinmore | 7·21 | 183 | 153 | *Wat.* | Waterford, Brook Lo.. | 3·08 | 78 | 84 |
| *Renf.* | Glasgow, Queen's Pk.. | 5·35 | 136 | 160 | *Tip.* | Nenagh, Cas. Lough... | 5·02 | 128 | 127 |
| „ . | Greenock, Prospect H.. | 9·94 | 252 | 145 | „ . | Roscrea, Timoney Park | 3·54 | 90 | ... |
| *Bute.* | Rothesay, Ardencraig. | 7·98 | 203 | 178 | „ . | Cashel, Ballinamona .. | 4·58 | 116 | 121 |
| „ . | Dougarie Lodge | 6·53 | 166 | ... | *Lim.* | Foynes, Coolnanes | 7·74 | 197 | 205 |
| *Arg.* | Ardgour House | 16·56 | 421 | ... | „ . | Castleconnell Rec. | 5·07 | 129 | ... |
| „ . | Manse of Glenorchy.. | 13·71 | 348 | ... | *Clare* | Inagh, Mount Callan .. | 10·72 | 272 | ... |
| „ . | Oban | 8·91 | 226 | ... | „ . | Broadford, Hurdlest'n. | 6·03 | 153 | ... |
| „ . | Poltalloch | 8·51 | 216 | 168 | *Wexf* | Newtownbarry | 4·15 | 105 | ... |
| „ . | Inveraray Castle | 15·23 | 387 | 185 | „ . | Gorey, Courtown Ho... | 3·23 | 82 | 104 |
| „ . | Islay, Eallabus | 7·28 | 185 | 156 | *Kilk.* | Kilkenny Castle | ... | .. | ... |
| „ . | Mull, Benmore | ... | .. | ... | *Wic.* | Rathnew, Clonmannon | 2·45 | 62 | ... |
| *Kinr.* | Loch Leven Sluice | 3·19 | 81 | 101 | *Carl.* | Hacketstown Rectory. | 3·45 | 88 | 97 |
| *Perth* | Loch Dhu | 11·60 | 295 | 128 | *QCo.* | Blandsfort House | 3·81 | 97 | 116 |
| „ .. | Balquhidder, Stronvar. | 11·91 | 303 | ... | „ . | Mountmellick | ... | .. | ... |
| „ .. | Crieff, Strathearn Hyd. | 5·01 | 127 | 124 | *KCo.* | Birr Castle | 3·38 | 86 | 119 |
| „ .. | Blair Castle Gardens .. | 4·85 | 123 | 146 | *Dubl.* | Dublin, FitzWm. Sq... | 2·12 | 54 | 93 |
| „ . | Coupar Angus School.. | ... | .. | ... | „ . | Balbriggan, Ardgillan. | 2·44 | 62 | 107 |
| *Forf.* | Dundee, E. Necropolis. | 1·91 | 49 | 98 | *Me'th* | Beauparc, St. Cloud .. | 2·86 | 73 | ... |
| „ . | Pearsie House | 2·17 | 55 | ... | „ . | Kells, Headfort | 3·35 | 85 | 106 |
| „ . | Montrose, Sunnyside.. | 1·81 | 46 | 91 | *W.M* | Moate, Coolatore | ... | .. | ... |
| *Aber.* | Braemar, Bank | 2·60 | 66 | 82 | „ . | Mullingar, Belvedere. | 3·50 | 89 | 109 |
| „ . | Logie Coldstone Sch. .. | 2·58 | 66 | 117 | *Long* | Castle Forbes Gdns. | 4·61 | 117 | 138 |
| „ . | Aberdeen, King's Coll.. | 1·87 | 47 | 86 | *Gal.* | Ballynahinch Castle .. | 8·59 | 218 | 138 |
| „ . | Fyvie Castle | 2·23 | 57 | ... | „ . | Galway, Grammar Sch. | 4·76 | 121 | ... |
| *Mor.* | Gordon Castle | 2·15 | 55 | 106 | *Mayo* | Mallaranny | 9·67 | 246 | ... |
| „ . | Grantown-on-Spey | 3·42 | 87 | 141 | „ . | Westport House | 7·97 | 202 | 171 |
| *Na.* | Nairn, Delnies | 2·52 | 64 | 127 | „ . | Delphi Lodge | 14·29 | 363 | ... |
| *Inv..* | Ben Alder Lodge | 6·78 | 172 | ... | *Sligo* | Markree Obsy. | 8·96 | 228 | 228 |
| „ . | Kingussie, The Birches | 4·40 | 112 | ... | *Cav'n* | Belturbet, Cloverhill.. | 3·34 | 85 | 112 |
| „ . | Loch Quoich, Loan | 22·30 | 566 | ... | *Ferm* | Enniskillen, Portora .. | 5·25 | 133 | ... |
| „ . | Glenquoich | ... | .. | ... | *Arm.* | Armagh Obsy. | 3·34 | 85 | 133 |
| „ . | Inverness, Culduthel R. | 3·76 | 96 | ... | *Down* | Fofanny Reservoir ... | 4·77 | 121 | ... |
| „ . | Arisaig, Faire-na-Squir | 8·84 | 225 | ... | „ . | Seaforde | 2·91 | 74 | 93 |
| „ . | Fort William | 13·84 | 352 | 144 | „ . | Donaghadee, C. Stn... | 3·10 | 79 | 122 |
| „ . | Skye, Dunvegan | 9·63 | 245 | ... | „ . | Banbridge, Milltown . | 2·48 | 63 | 111 |
| „ . | Barra, Castlebay | 4·91 | 125 | ... | *Antr.* | Belfast, Cavehill Rd. . | 4·44 | 113 | ... |
| *R&C* | Alness, Ardross Cas. .. | 5·47 | 139 | 144 | „ . | Glenarm Castle | 6·07 | 154 | ... |
| „ . | Ullapool | 7·92 | 201 | ... | „ . | Ballymena, Harryville | 4·04 | 103 | 109 |
| „ . | Torridon, Bendamph.. | 14·09 | 358 | 150 | *Lon.* | Londonderry, Creggan | 7·26 | 184 | 202 |
| „ . | Achnashellach | 14·87 | 377 | ... | *Tyr.* | Donaghmore | 4·25 | 108 | ... |
| „ . | Stornoway | 6·88 | 175 | 133 | „ . | Omagh, Edenfel | 4·74 | 120 | 134 |
| *Suth.* | Lairg | 5·93 | 151 | ... | *Don.* | Malin Head | 5·10 | 129 | 195 |
| „ . | Tongue Manse | 4·51 | 115 | 114 | „ . | Duntanaghy | 7·26 | 184 | 179 |
| „ . | Melvich School | 2·97 | 75 | 90 | „ . | Killybegs, Rockmount. | 10·28 | 261 | 184 |

# Climatological Table for the British Empire, August, 1926

| STATIONS | PRESSURE: Mean of Day M.S.L. (mb.) | PRESSURE: Diff. from Normal (mb.) | TEMPERATURE: Absolute Max. (° F.) | Absolute Min. (° F.) | Mean Values Max. (° F.) | Mean Values Min. (° F.) | Mean Values ½ max. and min. (° F.) | Mean Values Diff. from Normal (° F.) | Mean Wet Bulb (° F.) | Relative Humidity (%) | Mean Cloud Am'nt (0—10) | PRECIPITATION: Am'nt (mm.) | Diff. from Normal (mm.) | Days | BRIGHT SUNSHINE: Hours per day | Percentage of possible |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| London, Kew Obsy. | 1018·7 | + 3·4 | 82 | 46 | 72·1 | 55·0 | 63·5 | + 1·9 | 56·4 | 86 | 6·2 | 15 | − 42 | 11 | 6·7 | 46 |
| Gibraltar | 1017·0 | + 0·3 | 88 | 66 | 82·7 | 69·5 | 76·1 | + 0·1 | 67·9 | 82 | 4·7 | 4 | + 1 | 2 | ... | ... |
| Malta | 1017·2 | + 1·9 | 86 | 68 | 80·8 | 70·7 | 75·7 | − 3·4 | 70·7 | 83 | 2·3 | 0 | − 3 | 0 | 11·2 | 83 |
| St. Helena | 1016·3 | + 2·5 | 65 | 51 | 59·2 | 53·8 | 56·5 | − 1·4 | 54·2 | 94 | 3·6 | 72 | − 22 | 22 | ... | ... |
| Sierra Leone | 1013·9 | + 1·2 | 86 | 69 | 83·5 | 72·7 | 78·1 | + 0·2 | 74·7 | 87 | 8·2 | 65 | − 64 | 29 | ... | ... |
| Lagos, Nigeria | 1012·3 | − 1·3 | 83 | 70 | 80·2 | 72·8 | 76·5 | − 1·2 | 73·2 | 85 | 7·8 | 7 | − 64 | 6 | ... | ... |
| Kaduna, Nigeria | 1015·1 | + 1·3 | 87 | 63 | 83·1 | 65·7 | 74·4 | + 0·5 | 70·1 | 86 | 1·9 | 589 | +343 | 29 | ... | ... |
| Zomba, Nyasaland | 1024·7 | + 2·2 | 84 | 46 | 75·8 | 53·1 | 64·5 | − 0·4 | ... | 66 | 4·7 | 2 | − 8 | 4 | ... | ... |
| Salisbury, Rhodesia | 1019·1 | + 0·7 | 84 | 35 | 75·1 | 44·5 | 59·8 | − 0·4 | 50·7 | 45 | 0·9 | 0 | − 2 | 0 | 10·1 | 88 |
| Cape Town | 1021·6 | + 1·4 | 75 | 35 | 63·1 | 47·6 | 55·3 | − 0·3 | 49·1 | 85 | 5·1 | 76 | − 10 | 12 | ... | ... |
| Johannesburg | 1022·6 | + 1·6 | 77 | 23 | 67·4 | 44·3 | 55·9 | + 1·6 | 43·2 | 41 | 0·6 | 0 | − 13 | 0 | 10·2 | 92 |
| Mauritius | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Bloemfontein | ... | ... | 79 | 19 | 70·4 | 32·3 | 51·3 | − 0·9 | 39·5 | 48 | 1·4 | 0 | − 12 | 0 | ... | ... |
| Calcutta, Alipore Obsy. | 999·6 | − 1·4 | 91 | 75 | 87·6 | 79·0 | 83·3 | + 0·3 | 79·6 | 91 | 8·5 | 539 | +217 | 18* | ... | ... |
| Bombay | 1004·3 | − 1·6 | 87 | 76 | 84·7 | 78·0 | 81·3 | + 0·6 | 77·5 | 87 | 9·0 | 564 | +197 | 25* | ... | ... |
| Madras | 1005·6 | + 0·1 | 101 | 73 | 95·3 | 77·8 | 86·5 | + 0·6 | 76·4 | 73 | 8·9 | 118 | 0 | 9* | ... | ... |
| Colombo, Ceylon | 1009·4 | − 0·3 | 87 | 72 | 86·4 | 77·2 | 81·8 | + 0·7 | 78·7 | 78 | 7·2 | 135 | + 58 | 18 | 6·7 | 54 |
| Hongkong | 1006·7 | + 1·6 | 93 | 74 | 86·7 | 78·2 | 82·5 | + 0·4 | 78·5 | 81 | 7·5 | 203 | −154 | 17 | 7·0 | 54 |
| Sandakan | ... | ... | 91 | 71 | 88·4 | 75·7 | 82·1 | + 0·3 | 76·6 | 84 | ... | 98 | −107 | 8 | ... | ... |
| Sydney | 1016·1 | − 2·1 | 76 | 42 | 65·5 | 48·0 | 56·7 | + 1·7 | 50·4 | 68 | 4·4 | 24 | − 52 | 10 | 6·9 | 63 |
| Melbourne | 1015·2 | − 2·9 | 66 | 32 | 57·9 | 44·0 | 50·9 | − 0·2 | 46·8 | 78 | 6·6 | 39 | − 7 | 21 | 4·7 | 44 |
| Adelaide | 1016·2 | − 3·1 | 72 | 38 | 61·4 | 45·8 | 53·6 | − 0·4 | 48·3 | 69 | 5·8 | 106 | + 42 | 16 | 5·5 | 51 |
| Perth, W. Australia | 1019·1 | + 0·3 | 68 | 39 | 62·1 | 48·9 | 55·5 | − 0·4 | 51·4 | 72 | 7·1 | 155 | + 11 | 24 | 4·4 | 40 |
| Coolgardie | 1018·4 | − 0·9 | 78 | 32 | 64·4 | 39·8 | 52·1 | − 1·5 | 44·9 | 52 | 3·7 | 10 | − 16 | 4 | ... | ... |
| Brisbane | 1018·4 | − 0·8 | 80 | 41 | 74·1 | 51·9 | 63·0 | + 2·6 | 55·1 | 61 | 2·7 | 10 | − 44 | 5 | 9·2 | 83 |
| Hobart, Tasmania | 1010·1 | − 3·5 | 63 | 34 | 55·3 | 41·3 | 48·3 | + 0·3 | 43·0 | 72 | 6·3 | 48 | + 1 | 21 | 5·4 | 52 |
| Wellington, N.Z. | 1013·4 | − 1·7 | 60 | 33 | 54·4 | 42·9 | 48·7 | + 0·1 | 46·6 | 77 | 6·9 | 75 | − 39 | 21 | 4·1 | 39 |
| Suva, Fiji | 1015·9 | + 1·6 | 84 | 62 | 79·7 | 67·8 | 73·7 | 0·0 | 69·0 | 76 | 6·4 | 22 | −187 | 11 | 5·7 | 50 |
| Ap'a, Samoa | 1013·6 | + 1·4 | 88 | 70 | 85·4 | 74·1 | 79·7 | + 1·9 | 75·9 | 78 | 5·9 | 97 | + 17 | 11 | 7·8 | 67 |
| Kingston, Jamaica | 1013·7 | + 0·2 | 95 | 69 | 89·7 | 73·4 | 81·5 | 0·0 | 73·4 | 85 | 4·3 | 167 | + 74 | 13 | 8·2 | 65 |
| Grenada, W.I. | 1014·1 | + 1·5 | 90 | 73 | 86·1 | 75·9 | 81·0 | + 1·5 | 77·6 | 82 | 5·2 | 204 | − 39 | 24 | ... | ... |
| Toronto | 1014·9 | − 0·5 | 86 | 50 | 76·4 | 60·6 | 68·5 | + 1·9 | 61·5 | 77 | 5·6 | 155 | + 85 | 16 | 6·4 | 46 |
| Winnipeg | 1015·1 | + 1·2 | 92 | 43 | 75·1 | 53·5 | 64·3 | + 1·3 | ... | ... | 5·3 | 82 | + 20 | 12 | 7·9 | 54 |
| St. John, N.B. | 1015·3 | − 0·1 | 83 | 46 | 67·7 | 53·4 | 60·5 | − 0·1 | 56·6 | 80 | 5·3 | 45 | − 53 | 14 | 6·5 | 46 |
| Victoria, B.C. | 1015·9 | − 1·3 | 81 | 50 | 67·4 | 52·2 | 59·8 | − 0·3 | 56·0 | 82 | 6·0 | 29 | + 12 | 7 | 8·2 | 57 |

*For Indian stations a rain day is a day on which 0·1 in. (2·5 mm.) or more rain has fallen.

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 67·7 | 53·4 | 60·5 | − 0·1 | 56·6 | 80 | 5·3 | 45 | − 53 | 14 | 6·5 | 46 |
| Victoria, B.C. | 1015·9 | − 1·3 | 81 | 50 | 67·4 | 52·2 | 59·8 | − 0·3 | 56·0 | 82 | 6·0 | 29 | + 12 | 7 | 8·2 | 57 |

*For Indian stations a rain day is a day on which 0·1 in. (2·5 mm.) or more rain has fallen.